MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

PPH0255 – PHYSICS

(Foundation in Information Technology)

17 October 2018
2.30 P.M - 4.30 P.M
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 printed pages with 5 questions only, excluding the cover page physical constants and formula list.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

LIST OF PHYSICAL CONSTANTS

Acceleration due to gravity	g	$9.80\ \text{m/s}^2$
Electron mass	m_e	$9.11 \times 10^{-31}\ \text{kg}$
Proton mass	m_p	$1.67 \times 10^{-27}\ \text{kg}$
Elementary Charge	e	$1.602 \times 10^{-19}\ \text{C}$
Coulomb Constant	k	$9.0 \times 10^{9}\ \text{N m}^2.\ \text{C}^{-2}$
Permittivity of free space	ε_0	$8.85 \times 10^{-12}\ \text{C}^2\ \text{N}^{-1}.\text{m}^{-2}$

LIST OF FORMULA

NEWTONIAN MECHANICS

$$\omega = \frac{\Delta\theta}{\Delta t} \qquad v = r\omega \qquad a = r\alpha$$

$$\omega = \omega_o + \alpha t \qquad \theta = \frac{1}{2}(\omega_0 + \omega)t \qquad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\theta \qquad \theta = \omega t - \frac{1}{2}\alpha t^2$$

$$W = Fs\cos\theta \qquad KE = \frac{1}{2}mv^2 \qquad PE_G = mgy$$

$$P = \frac{W}{t} = \frac{E}{t} = \frac{Fd}{t} = F\bar{v} \qquad p = mv \qquad \sum F = \frac{\Delta p}{\Delta t}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \qquad m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$$

ELECTRICITY

$q = Ne$

$F = k\frac{q_1 q_2}{r^2}$

$E = \frac{F}{q_o}$

$E = k\frac{q}{r^2}$

$\Phi = EA\cos\theta$

$\Phi_c = \frac{q_{in}}{\varepsilon_o}$

$V = \frac{U}{q_o}$

$V = \frac{kq}{r}$

$U = k\frac{q_1 q_2}{r_{12}}$

$C = \frac{\varepsilon_0 A}{d}$

$Q = CV$

$C = \kappa C_0$

$C_{eq} = C_1 + C_2 + \ldots.$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots.$

$V = E\,d$

$U = ½\,QV$

$U = ½\,CV^2$

$U = \frac{Q^2}{2C}$

$u_E = ½\,\varepsilon_o E^2$

$I_{av} = \frac{\Delta Q}{\Delta t}$

$V = IR$

$R = \rho\frac{L}{A}$

$R_{eq} = R_1 + R_2 + \ldots$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

$P = IV$

$P = I^2R$

$P = \frac{V^2}{R}$

$V = E - Ir$

STRUCTURED QUESTIONS [50 MARKS]

Instructions: Answer **ALL** questions in this section.

Question 1 [10 marks]

a. A wheel rotates with a constant angular acceleration of 3.50 rad/s^2 . If the angular speed of the wheel is 2.00 rad/s at $t_i = 0$,

i. through what angle does the wheel rotate between $t = 0$ and $t = 2.00$ s? Give your answer in radians and revolutions. (2 marks)

ii. What is the angular speed of the wheel at $t = 2.00$ s ? (2 marks)

b. A compact disc rotates from rest up to an angular speed of 30.0 rad/s in a time of 0.8 s.

i. What is the angular acceleration of the disc, assuming the angular acceleration is uniform? (2 marks)

ii. Through what angle does the disc turn while coming up to speed? (2 marks)

iii. If the radius of the disc is 4.5 cm, find the final tangential speed of a microbe riding on the rim of the disc. (1 mark)

iv. What is the magnitude of the tangential acceleration of the microbe at the given time? (1 mark)

Question 2 [10 marks]

a. A sledge loaded with bricks has a total mass of 18.0 kg and is pulled at constant speed by a rope inclined at 20.0^0 above the horizontal. The sledge moves a distance of 20.0 m on a horizontal surface. The coefficient of kinetic friction between the sledge and the surface is 0.500.

i. What is the tension in the rope? (3 marks)

ii. How much work is done by the rope on the sledge? (1 mark)

iii. What is the mechanical energy lost due to friction? (3 marks)

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b. A 1200 kg car travelling initially with a speed of 25.0 m/s in an easterly direction crashes into the rear end of a 9000 kg truck moving in the same direction at 20.0 m/s. The velocity of the car right after the collision is 18.0 m/s to the east. What is the velocity of the truck right after the collision? (3 marks)

Question 3 [10 marks]

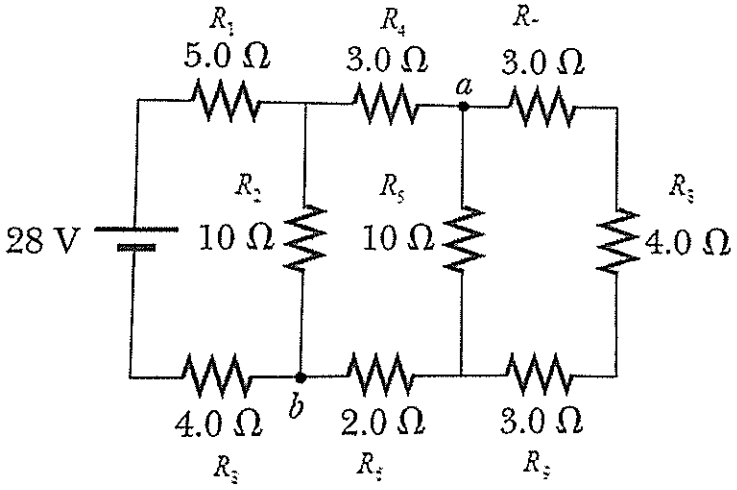

Figure Q3

For the circuit in **Figure Q3** calculate,

a. the equivalent resistance (5 marks)

b. the power dissipated by the entire circuit (2 marks)

c. the current in the 5.0 Ω resistor. (2 marks)

d. the potential difference across R_3. (1 mark)

Question 4 [10 marks]

a. i. Determine the magnitude and the direction of electric field 50 cm from a point charge Q_1 which carries a charge of 5pC. (3 marks)

ii. Determine the magnitude and the direction of the electric force exerted on a second charge Q_2, 5nC which is placed 0.5 m from charge Q_1. (3 marks)

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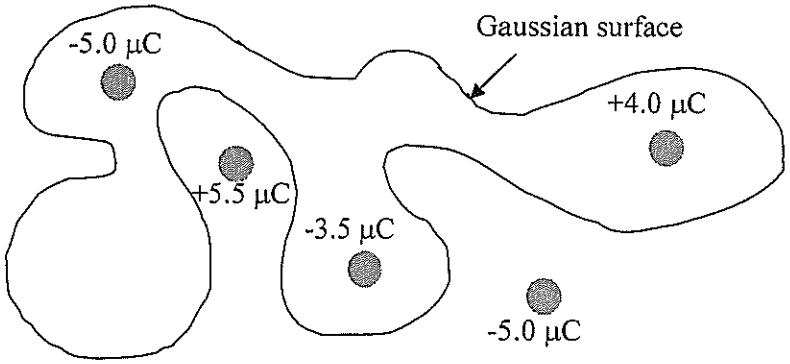

Figure Q4(b)

b. **Figure Q4(b)** shows a closed surface surrounding some electric charges.

i. Determine the net electric flux through the surface? (2 marks)

ii. Is the net electric flux directed inward or outward from the surface? Explain. (1 mark)

iii. The magnitude and the sign of the charge to be added so that the net electric flux through a closed surface consists of all these charges is zero (1 mark)

Question 5 [10 marks]

a. Define the following terms:

i. Free electrons.

ii. Trivalent atom.

iii. Doping

iv. Valence electron

v. Minority carrier.

vi. N-type semiconductor (3 marks)

Continued...

b. Sketch the bonding structure for *n*-type semiconductor. (2 marks)

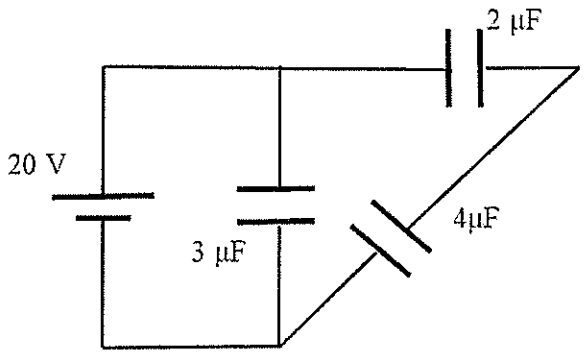

Figure Q5(c)

c. Three capacitors are connected as shown in **Figure Q5(c)**

i. What is the equivalent capacitance of the combination? (2 marks)

ii. Find the charge stored on each of the capacitors. (3 marks)

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